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DEPARTMENT OF AGRICULTURE

(LIVE-STOCK BRANCH)

PROVINCE OF BRITISH COLUMBIA

NATURAL AND ARTIFICIAL INCUBATION AND BROODING

BULLETIN No. 39

(SECOND EDITION)

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
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DEPARTMENT OF AGRICULTURE,
VICTORIA, B.C., JANUARY, 1914.

The Honourable Price Ellison,
Minister of Agriculture.

SIR,—I have the honour to submit herewith Bulletin No. 39, compiled by J. R. Terry, Chief Poultry Instructor, entitled "Natural and Artificial Incubation and Brooding."

I have the honour to be,
Sir,
Your obedient servant,
WM. E. SCOTT,
Deputy Minister of Agriculture.

Acknowledgments are due to the following for loan of cuts used in the following pages: Prof. J. Dryden, Corvallis, Ore., and Prof. J. Rice, Cornell University, Ithaca, N.Y.

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PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF AGRICULTURE
(LIVE-STOCK BRANCH)

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Minister of Agriculture.

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Deputy Minister of Agriculture.

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Secretary to the Department.

NATURAL AND ARTIFICIAL
INCUBATION AND BROODING

INTRODUCTION.

THIS bulletin has been prepared with the idea of helping, if possible, those already in the poultry business, both large and small breeders, who have, perhaps, experienced some difficulty in the hatching or brooding branch of their work, and those without experience who intend starti·· in this branch of agriculture.

THE ESSENTIALS OF SUCCESSFUL INCUBATION.

The most common cause of poor results or failure in incubation is the use of eggs of low vitality. Successful incubation begins long before the eggs are laid. The eggs must be from stock of high vitality that have never been forced; that are fed all the green food they will eat, and some form of animal food as well as grain. While fowls will sometimes lay a goodly number of eggs upon a grain diet, yet the eggs are oftentimes lacking in those food elements that the embryo requires, and they often hatch poorly, and those chicks that do hatch will be of impaired vitality, very difficult to raise. The vitality of the breeding stock, food or housing, and the range should be carefully looked after, as the neglect of any one of these factors will impair the vitality of the stock; consequently the eggs will not give good results with either incubator or hen.

VIGOROUS BREEDING STOCK NECESSARY FOR SUCCESSFUL INCUBATION.

The Male.

Care should be exercised in the selection of the male, since his influence in the flock is so great. He should be fully matured and well developed, though not too heavy. Medium-sized male birds give good results when mated to hens of good proportions. That he be a sound bird constitutionally is of vital import. His head should give every evidence of masculinity, and should be of good size and of symmetrical proportions. A bright eye and a rather short, stout beak are other requisites. The body should present a symmetrical appearance, being filled out and carried well on stout legs of medium length, set well apart. In general, he should be active, a bird of quality, and one possessed of abundance of vitality and vigour.

The Female.

The above general characteristics may also be applied to the female. A two-year-old, a yearling hen, or a well-grown, well-developed, and fully-matured pullet may be used, but only when absolutely necessary. Many times the vigour of the flock has been greatly reduced by breeding from pullets. In some places where the raising of poultry is the main industry, the size of the fowls as well as the eggs has been reduced in just this way. Breeders are beginning to realize the necessity of breeding from fully matured, well-developed fowls if vitality, vigour, and prolificacy are to be maintained year after year. Indications as noted in the male will suffice to differentiate the desirable from the undesirable type. Generally speaking, about ten or fifteen females is considered a sufficient number for one male of the general-purpose breeds, such as Rocks, Wyandottes, Orpingtons, and Reds, and from fifteen to twenty for the Mediterranean breeds, as Leghorns and Anconas. The exact number of birds per male in either class depends greatly upon the vigour and constitution of the particular male bird used.

Among the contributory causes to the loss of physical vigour are the following: The greatest and most potent cause is soil-contamination, congestion and crowding of breeding stock upon limited areas, bringing with it lack of exercise, improper housing and feeding; in-and-in-breeding, without selecting the most vigorous birds; the too-common use of pullets, instead of matured fowls, for breeding stock; forced egg yield by heavy feeding during the fall and winter; carelessness in keeping eggs for incubation; hatching from eggs selected indiscriminately; faulty methods of incubation; the use of poor incubators and brooders; too rapid forcing on rich, easily assimilated food, with lack of exercise; general violation of the principles of sanitation and brooding, housing and range; failure to select breeding stock of recognized superior physical vigour; the use of birds that have been hatched too early—that were stunted in growth or hatched too late, and were not grown under proper conditions, and do not reach full size when breeding season commences.

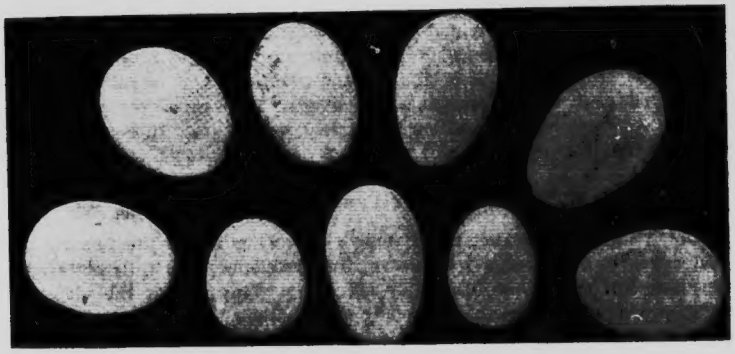
It is impossible to pass judgment on the merits of any particular variety or individuals of the breed without knowing how they have been bred and handled, but there are some physical characteristics that will aid any one in selecting breeders that are very apt to turn out to be of strong vitality and vigour, and only such should be placed in the breeding-yards.

HOUSING OF BREEDING STOCK.

The necessity of fresh air is being realized to a greater extent than ever before. Poultrymen are finding that to have the best success with their breeders they must be kept under as natural conditions as possible. Fresh air is of great value, especially at night. Besides keeping the birds in fresh-air houses, they should, if possible, be given free range, or at least 75 square feet per bird of yard-room.

EGGS USED FOR INCUBATION.

Together with the selection of the breeders, a careful selection should be made of the eggs laid by the breeding stock. A poor egg, even from one of the best breeders, should not be used. A poorly shelled, an unevenly shaped egg, or one otherwise lacking in qualities which make up a good egg, should be discarded. The normal egg is one of average size, weighing about 2 oz., with a smooth surface and



Eggs unsuitable for hatching purposes. Rough-shelled, deformed, undersized, double-yolked, mottled shelled, elongated, or globular eggs will give very poor results, being mostly infertile.

an even shape, being slightly larger at one end than the other. An extra large egg or a small one should be rejected; the large ones are seldom fertile, and the small ones, if fertile, produce very small chicks. There is nearly always a percentage of eggs from any flock which have never been fertilized. There may be also broken yolks, "green" eggs, "blood yolks," mottled and cracked shells. None of these, of course, are satisfactory for incubation.

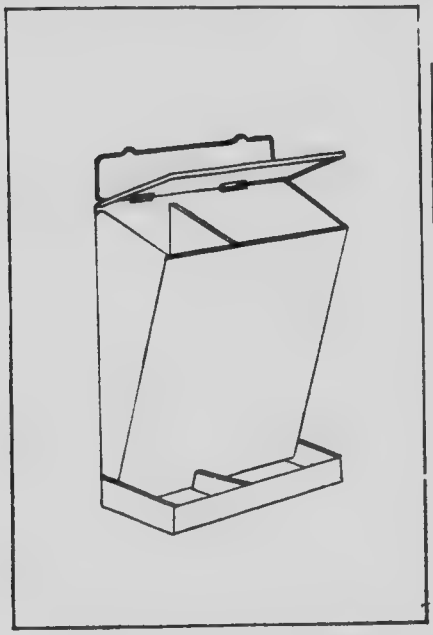
NATURAL INCUBATION.

On many farms the number of fowls kept is too small to warrant the use of an incubator. On such places the chicks are hatched by the hen, and for such as use this method the remarks in this chapter are intended. When setting hens, it is important that the proper surroundings be provided. Where good eggs are used and poor hatching results are secured, this can often be attributed to poor accommodation.

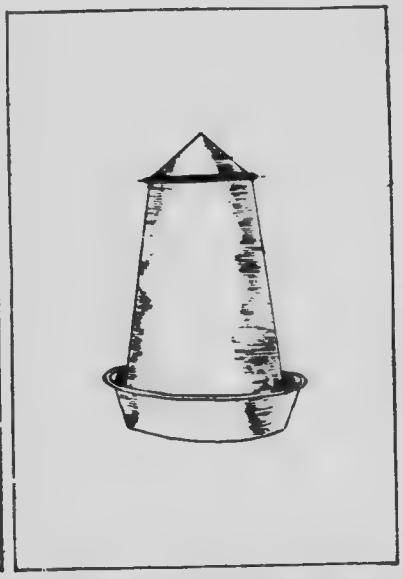
An egg-tester. When using this type of tester, it is dangerous to hold the egg against the tester too long, as sometimes the extreme heat will kill the egg-germ.

To get the best results from sitting hens, the nest should be large and roomy, and not too far from the floor. A box, about 18 inches square and about a foot deep, should be half filled with moist earth or an upturned sod, and care taken to hollow out the earth somewhat in the centre. Experiments have proved the superiority of nests composed of moist earth over nests which are of dry earth, sand, or ashes. The moist earth approaches nearest to nature, and helps to retard evaporation of the egg-content during incubation. See that the earth in the corners of the box slopes towards the centre, so that the eggs cannot roll out of the nest and get chilled. Then place a small quantity of fine-cut straw, hay, or excelsior in the nest. Care should be taken that sufficient straw or hay be placed in the nest, so that the moist earth does not chill the eggs.

The room where the nests are placed should, contrary to general instructions on this matter, be well lighted, but cool. This can be secured by having the nests placed in a room where the windows face the north, if possible, and lots of room should be provided for exercise when the hen comes off. Many cases can be recorded of hens forsaking the nest, and even dying, through lack of room to exercise.



A useful grit, charcoal, or shell hopper.



A drinking fountain of useful design. A disused salmon-can with small hole pierced in the top and a saucer answers very well for individual hen and chicks.

Yearling or older hens are more reliable than pullets as sitters, and are preferable whenever possible. Hens or pullets that are of an excitable disposition should never be used as sitters. In the Rhode Island districts, where millions of chicks are hatched yearly by the natural method, it is the custom to specially mark and keep hens that show good hatching power and ability.

Medium-sized hens are best for incubation purposes, because they are less liable to crush eggs than if large heavy hens are used. Even with hens the hatching period

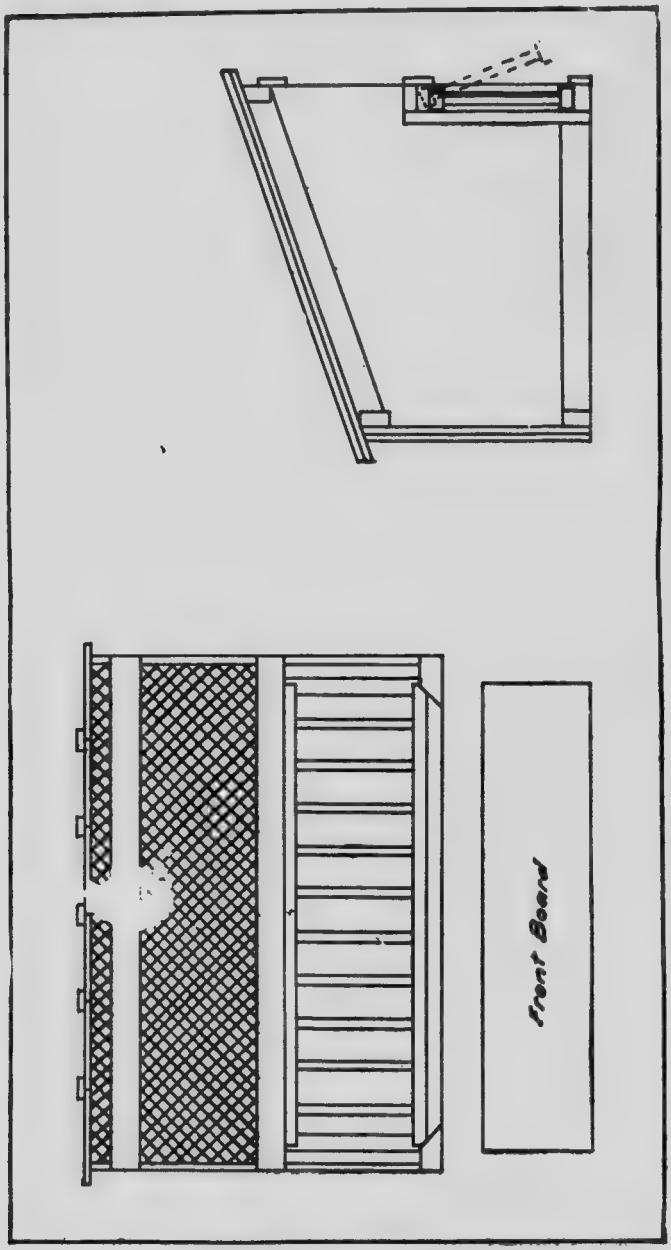


Fig. A.—Sketch of first-class hen or A coop. The wire at top admits sufficient fresh air, and yet is not too cool for any but very severe weather. Early in spring it is advisable to set the coop on a board bottom, detached from the run, to allow of easy cleaning. When no bottom is used, the coop should be either moved forward or to one side, never backwards, because of the danger from feeding chicks amongst filth. A little air-slaked lime should be sprinkled over portion of soil used.

varies. A hen that frequently leaves the nest will not hatch out chicks as quickly as a hen that broods closely, and only leaves the nest probably once every two or three days.

A dust-box should be provided, and should be at least 8 inches deep, and filled to within 2 or 3 inches of the top with earth or road-dust mixed. A handful or two of powdered sulphur sprinkled in the dust-box is also helpful.

The proper time to set a hen is after dark. Place two or three infertile eggs in the nest beforehand. It is advisable to have these warm, if possible, especially early in the season, as a hen will often take a dislike to stone-cold eggs. Sometimes it is advisable to place a basket over the hen when sitting, and remove this after the first day. When sitting hens are attended to at regular intervals, it is not necessary to coop a hen up in this fashion. Allow them to come off when they feel inclined, and if they do not come off daily, then they may be lifted from the nest. This should be done carefully, and as follows: Lift out both wings first, and then gently lift with both hands pressed to the sides of the hen. If the wings are not opened out, an egg or two is often cracked by being lifted up with the hen, and then falling on the eggs in the nest.

The eggs should be tested the seventh day in the same way as those in incubators, removing the infertile and those in which dead germs appear. An egg-tester can be procured at any poultry-supply house for a small sum. They are generally given free to purchasers of incubators. An acetylene cycle lamp makes a first-class tester. If a number of hens are set at the same time, the fertile eggs, after testing, can be rearranged under the hens necessary to cover them, and the remainder of the hens reset or placed back in the laying or breeding house, as desired.

From the seventh to the ninth day the fertile eggs with live germs will have a dark spot, the germ, in the larger end with the veins radiating from it, making a spider-like appearance. Eggs showing a red ring, or eggs showing a dark spot without blood-vessels, clouded or infertile eggs, should also be removed.

The eggs should again be tested on the fourteenth or fifteenth day, removing any in which the chicks have died.

If testing takes place on the sixteenth or seventeenth day, at this stage of incubation a live chick will have darkened all the egg with the exception of the air-cell. If the egg is closely watched, a movement of the chick can often be detected.

The eggs should be examined every other day to see if they have been soiled. Should this happen, wash them in water of 90 degrees temperature, and dry before putting in nest. Dust the hen, when first setting, and on about the seventeenth day, with a good dusting-powder.

Place a pan of whole corn or corn and wheat near the nest, some clam or oyster shell, and about every other day provide a sod of young tender grass-shoots. Change the drinking-water frequently.

Immediately after the chicks are removed, the litter should be taken out of the box and burnt, the box washed or disinfected, and placed in the sun to dry before using again. Setting a hen on a nest that has been previously used is an unprofitable proceeding, for red mites will generally put in an appearance, and they are easier to rear than chickens.

By having the nest box a foot deep, the chicks are not liable to ge . and probably get chilled; or, as sometimes happens, a hen will leave ten ch n the nest, to mother one that has fallen out.

BROODING CHICKS WITH HENS.

The hen with her brood should not be disturbed too frequently during the first few days after hatching. As the chicks develop they require less restricted quarters, but it is wise to keep the mother hen confined. Chicks should not be allowed to run through long wet grass or grass heavy-laden with dew. Where the grass is long it is advisable to cut short a small space around the chicken-coop.

Upon removal, which should take place twenty-four hours after the last chick has hatched, the first feed may consist of dried bread-crumbs, crushed egg-shell, or

oatmeal, with milk, if possible, to drink. Various other kinds of feeds may be used, such as commercial chick-feed, hard-boiled egg, bread and milk (the bread being squeezed dry), etc. When buying chick-feed, if possible purchase it without the grit added. The latter is very heavy, and some samples contain more grit than necessary.

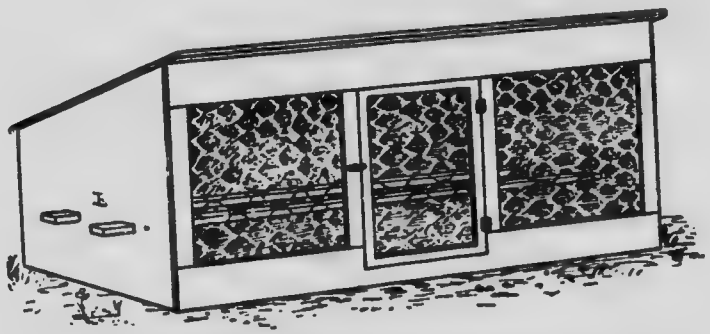
A mash which the author has found to give splendid satisfaction is composed as follows: Two large slices of dry bread, two hard-boiled eggs (shells included), one medium-sized onion, and a piece of charred bone, about walnut size.

The eggs and onions will generally provide all moisture needed to mix the mash. These ingredients are ground up very fine in a meat-mincer. Feed this about twice daily; the other feeds to consist of rolled oats, commercial chick-feed, or bread and milk. It is not advisable to feed beef-scraps to little chicks under fourteen days old. The chicks need feeding at least four times daily the first month, the amount to be given to be judged by the attendant. By experience and observation, coupled with intelligence, a poultryman or woman will soon be able to give the right quantity desired at each meal. After a month's hand-feeding the chicks can be hopper-fed, as explained in the chapter on feeding.

A good coop for hen and chicks is shown in Fig. A. This coop is easily constructed and may be moved about readily. It is 2 feet high in front, 15 inches high at the back, and is 2 feet wide by 3 feet in length. The wire portion is 1 foot in width. The board is used to cover the front at night, and utilized in the daytime to place the food on. The board should be scrubbed at regular intervals if used for a feed-board.

As soon as the chickens are large enough to do without the mother, say at from five to eight weeks, the hen should be placed back in the laying-house with the adult fowls. When the chicks get too large for the Coop A, which will be in about ten weeks, they are put into B coop. Overcrowding of young stock is to be guarded against, as once they get a set-back in this way it is likely to be noticed all winter. Roup, stunted growth, bronchitis, etc., can be directly attributed to overcrowding during growth.

The B coop in illustration will accommodate twenty chicks until full grown.



B or secondary coop. Dimensions: Length, 6 feet; width, 2 feet 6 inches; height, front 2 feet 4 inches, back 18 inches. A hen's brood of chicks, at about eight weeks of age, should be placed in here from smaller quarters, or the B coop itself makes a splendid coop for hen and chicks from the start. When using the coop for this purpose, the roosts can be removed, and roost-holes in ends covered temporarily with a shingle tacked over to keep out draughts and vermin.

The coop should be moved its own length or width about twice weekly, and lime sprinkled on land so used. When moving see that it is placed forwards or sidewards, never backwards, as this brings the droppings to the front of the coop. In the case of colony houses, the manure should be collected, and taken away to compost heap, rather than scattered around near the colony houses. The latter procedure has often been the means of spreading epidemics amongst the flocks.

ARTIFICIAL INCUBATION.

While the law of incubation seems comparatively simple, yet the proper application of these principles in an incubator is extremely difficult. It means a well-built case, to withstand both moisture and changes of outside temperature; a reliable and constant source of heat; a uniform distribution of the heat, so each egg gets a uniform amount; a sensitive and reliable regulation; constant ventilation, and the constant supply of humidity, to prevent the excessive evaporation of the eggs, and withal so arranged as not to introduce undesirable factors which work injury to the developing embryo or germ.

Briefly stated, all that is required to hatch eggs artificially is a temperature of 100½ degrees at the centre of the eggs (101 to 103 degrees by contact). At the same time the eggs should be immersed in still air (quiescent atmosphere) containing moisture of a relative humidity of 45 to 70 per cent. If we can believe the incubator manufacturers, their respective machines are built so that the exact humidity necessary is supplied.

This atmosphere should be changed sufficiently often to carry off the waste gases eliminated by the eggs. Any excess of ventilation beyond this may be deleterious.

There is a great difference in the various types of incubators manufactured. The use of the standard makes will prove more satisfactory. Many machines have been placed on the market which will hatch successfully for one or two seasons, and

Mammoth Incubator of 10,000 eggs capacity. These machines are coming into use on some of the larger ranches, where they are used principally for custom hatching.

then practically become worthless. They have been constructed of cheap materials, have not been put together very well, and cannot be relied on to give satisfactory hatches season after season. Then, again, there are some machines placed on the market which, as regards manufacture, are all that can be desired, but fail to give good results simply, because the temperature-regulating device is cheap, flimsy, and unreliable. Therefore it is wise to take no risk with inferior makes, but secure durable and efficient machines with which to do this important work.

There are many different kinds of machines, but a description of all of them is quite impossible in a publication of this kind. They are nearly all constructed on

similar principles and along the same lines. The majority of them receive their heat from lamps that burn kerosene. In some places gas is being used for heating purposes. Recently a few makes have been constructed with electrical attachments. However, the employment of gas or electricity in incubators depends largely upon local conditions, and these methods of hatching chicks will not be discussed here.

The hot-air and hot-water incubators usually hatch with equal success, each involving the same general principles, with slight variations of minor importance.

THE LOCATION OF THE INCUBATOR.

Much depends upon the location of the incubator, for the reason that influences external to the incubator may influence the hatch. The incubator-cellar should be well ventilated, thus providing for an abundant supply of oxygen for the developing chicks. Although fresh air is essential, direct draughts through the cellar should be avoided. The cellar should be clean and sweet smelling.

The most successful incubator-rooms are built half in the ground and half above ground, because of the more equable temperature obtained. A house 4 feet in the ground and 3 or 4 feet above makes an ideal place for the incubator. Where this is not possible, the incubator-house should be built on the north side of a house, barn, or building, and the windows placed on the north side.

A house-cellar, providing it is sweet and clean, may be utilized. However, where so done, it is advisable to apply to the fire insurance company for permission, as some companies will not allow incubators to be operated in a house-cellar or room.

A-shape colony house, suitable for growing stock. The writer has found that this type of house affords too much surface to the sun's rays during the day. However, when placed under trees it is satisfactory.

THE OPERATION OF THE INCUBATOR.

The degree of success in incubation depends to a great extent upon the operation of the incubator for the first week. It may be well to point out that it is very desirable, especially for amateurs, to follow the directions of the manufacturer more

or less closely. It is very important that the thermometer used is absolutely correct, and should be tested before setting the machine. Most druggists or opticians will test thermometers free, or for a nominal sum.

The incubator should be started a few days before the eggs are to be placed in the egg-chamber, so that a temperature of 103 degrees may be readily maintained. The temperature which the thermometer should register, however, depends somewhat upon its position in the incubating-chamber. The eggs should not be placed in the incubator until a fairly uniform temperature has been maintained. An important factor which has to do with the maintaining of a uniform temperature is the flame. The wick of the incubator-lamp should be trimmed in such a manner as to give a broad, even flame, the corners of which are slightly rounded. When the wick is in use it should be trimmed in the following manner: With the fingers rub off the charred portion carefully, and light. If an even flame does not show as the wick is turned up, remedy the defect, and then round off the corners of the wick so that no smoking will result.

Small colony houses in use at the Oregon Agricultural College, Corvallis, Ore. The writer would substitute cloth or glass for the hinged board shutters, preferably one of each kind.

Most of the large hatching establishments do not commence to turn eggs till the evening of the third day. The eggs require to be turned often. The purpose of turning them is to prevent the embryo in the egg from sticking to the shell, for should this occur growth would be stopped. It is still an open question whether turning eggs twice daily during incubation is sufficient. It is known that the hen turns the eggs more than this number of times, some having been observed to continually turn the eggs. However, most authorities on the subject advise twice daily. Where good results are obtained from this procedure, it would be unwise to depart therefrom.

Regarding the use of moisture, experiments have proved that where moisture has been supplied the chicks are generally larger and more vigorous. As to the exact or proper amount of moisture to use, this is a very difficult question to answer satisfactorily. However, it is generally conceded that to be of use the moisture needs

to be used right from the beginning of the hatch. Several large operators state it as their opinion that along the Coast and on Vancouver Island moisture is not needed owing to the heavy rainfall, and others yet again declare that they use moisture and get better results in these same districts than they did when operating their machine without moisture.

It has been proved by exhaustive experiments that the evaporation of eggs during artificial incubation is greater than by natural methods, and to even up this evaporation the supplying of moisture is the only solution thus far advanced.

Some machines are equipped with moisture-pans, and others classed as non-moisture incubators are not provided with this apparatus. Where it is decided to apply moisture, this can be done by procuring a shallow pan, about 1 inch in depth, or several small pans. Where one pan is used, it is important that the pan should be at least an inch less in length and width than the bottom of the incubator to allow proper ventilation. The pan should always be supplied with water, for should it run dry it is liable to affect the temperature adversely.

Regarding the practice of cooling the eggs, no set rules can be laid down as to the exact time to be allowed for cooling. Some operators get good results without cooling, others with slight cooling, and yet, again, others cool very freely and get satisfactory results. A lot depends on the time of year, whether the machine has been overheated or the reverse, temperature of the room, and also age of eggs, as to how long it is advisable to cool. Should cooling be practised, it is the general rule to cool very little the first week, and gradually increase the period up to the night of the seventeenth day, after which the eggs should not be disturbed.

A flock of birds the picture of health and vigour, a combination exemplified wherever proper attention, right feeding, and sufficient free range is provided.

It has been found that where an incubator-room temperature is above 70 degrees, the ventilators of an incubator are not of much avail for furnishing additional ventilation; but where the room temperature is low—from, say, 55 degrees to as low as 45 degrees—the ventilators will be found much more effective.

Whilst cooling the eggs it is advisable, especially in a cool room, to cover the eggs with a blanket, and also to see that the tray does not overlap the incubator-top. Eggs thus exposed get chilled much quicker than the rest of the tray, and may be injuriously affected thereby.

The chicks should not be removed from the incubator till at least twelve hours after the last chick has hatched, but the tray and shells may be removed as soon as the chicks are dry. This will give the chicks more room. Great care should be

taken not to overheat the chicks whilst they are in the incubator. In hot weather it may be necessary to open the door an inch or so to provide additional ventilation. Chicks should on no account be allowed to pant. This is the primary cause of much mortality by lung-affections.

TESTING.

The germ will show signs of development within a few hours of its first exposure to heat. It is not until about the fourth or fifth day that any marked difference between fertile and unfertile eggs may be detected with the naked eye. The unfertile eggs and those with dead germs are usually tested out twice during the hatch, on the seventh and sixteenth days generally. The process of testing is simple, and after a little experience is easily acquired. The appearance of the egg can be clearly seen when placed between the light of the tester and the eye.

When testing, care should be taken to see that the eggs are not held too close to the tester. If this precaution is not taken, the heat generated by the testing-lamp will kill the germ. Temperatures of 150 to 180 degrees have been obtained by holding thermometers for a few seconds against the mouth of the tester

When testing, the egg should be lifted straight from the tray to the lamp without turning or twisting, because by so doing the yolk is frequently ruptured.

ARTIFICIAL BROODING.

There are many different methods employed in the brooding of chicks. The advantages and disadvantages of these methods will be pointed out. The main things in artificial brooding is sufficient even temperature and cleanliness. Little

Colony houses and hen-coops on free range. A cornfield makes ideal range for poultry, giving plenty of shade, and owing to continual cultivation needed during the major portion of growth, provides chicks with an incalculable quantity of animal food. The corn acts as a splendid protection from hawks and crows.

chicks three or four days old are fairly hardy creatures, but when placed under extreme conditions weakness or death is sure to follow. The chick's lungs are situated along the spinal column, and are protected only by a thin membraneous lining over which a light covering of feathers grow. Provided with such meagre protection, the lungs may become readily chilled or overheated. An even temperature, with as few variations as possible, is most desirable. The brooder should be started up a day or two before the chicks are ready to be placed in it, so that an even temperature of about 95 degrees may be maintained. This temperature should

be gradually lowered, and it depends upon the season of the year just how much it should be lowered. The poultryman must use his judgment and operate the brooder according to the condition of the chicks. Many poultrymen use no thermometer in their brooders. They study the chicks, and can tell by looking at them if the temperature is right. This emphasizes the fact that for best success the poultryman must understand his business.

If a brooder has contained chicks before, it should be thoroughly cleaned and disinfected before putting in a new brood, both to discourage lice and to kill any disease germs that might be lurking in the cracks and corners. Scrub thoroughly with hot water, in which has been placed good commercial disinfectant or cresol soap. The brooder should be thoroughly dried before the chicks are placed inside.

In the round hover, instead of gradually reducing the temperature by changing the regulator, it is preferable to tuck up the curtain a little at a time as the chicks increase in age, and give them more air, which has the advantage of reducing the temperature, and the fresh air aids to quick development and hardiness.

THE COLONY SYSTEM.

The majority of poultry-breeders employ the colony system in brooding their chicks. The individual hover is used probably more than any other. This hover may be placed in almost any kind of a house, and is sometimes used in long continuous brooder-houses. It gives very good satisfaction, and is easily operated. About fifty or sixty, and with some hovers seventy-five, chicks may be brooded under one hover until they are five or six weeks old. In the case of colony houses, the hover can then be removed and roosts placed in position.

Combination colony brooder-house, breeding or laying pen. The house in illustration is 8 feet deep and . feet long, and will accommodate up to 300 chicks; is built upon two 4 x 4-inch runners, and has two sliding windows in front. Can be used as a primary brooder till chicks are past the danger-point, i.e., the first fourteen days; and they can then be removed to colony houses on free range. When used for this purpose, the house can be stationed close to farm buildings and enable rancher to pay more attention to chicks with less labour and time than when they are out on free range.

To save the expense of a brooder-house for comparatively early spring work, when the weather is bad, and before green food is available on the range, colony houses can be brought up near the farm buildings. The limit of time for caring for the chicks can be much reduced by this method. As soon as the weather moderates, however, it is very desirable that the chicks be placed out upon the open range.

The house in the illustration is 8 x 16 feet, and will hold four hovers, with a capacity of fifty chicks in each. This can be utilized as a breeding-pen, laying-pen, or cockerel-pen later on. Twenty or twenty-five birds can be easily accommodated. This house can be readily moved by a team of horses. The advantages of the colony-house brooding system over the permanent continuous brooder-house are that no permanent wire fencing is needed, except a small portable fence of 2-foot ½-inch

mesh wire, to be used for a day or two when the chicks are first put in the brooder; they can be moved to any part of the ranch, thus giving the chicks the benefit of clean virgin soil and free range. On the other hand, a hot-water pipe brooder-house can only be used during the hatching period. It is generally not suitable to place half-grown or mature fowls in, because of the danger from lice, red mites, or disease, and lack of sufficient ventilation for large fowls.

An illustration is given of a combination colony house that can be used with an individual hover in rearing young chicks or for growing stock upon the open range. In the winter-time it may be used for a laying-house. This house can be closed during early spring work for rearing young chicks, and ventilation secured through a cloth screen, which can take the place of the tight-board shutter as seen in the illustration. When used for growing stock or laying hens, the windows and screens are opened, so as to make it practically any open-front colony house. The colony houses may be put upon runners, so as to be drawn readily from place to place. The colony house should not be less than 6 x 6 feet, 6 x 8 feet, or 8 x 10 feet in size. Permanent colony houses are usually 8 x 16 feet in size.

A good type of colony house. Measurements, 6 feet long, 8 feet deep, 6 feet 6 inches in front, 4 feet 6 inches rear. Colony houses can be hauled to any part of the ranch, thus giving young or old stock opportunity to range on clean soil. Can be used as cockerel, pullet, or breeding houses after chickens are matured. The top shutter or board window makes a splendid hood or rain-shield and can be changed to a muslin-curtain screen if desired.

After the chicks are a month old, the house can be raised up about a foot from the ground, providing splendid shade for the chickens, and also preventing rats or vermin from sheltering underneath.

Where chicks are raised on free range in this fashion, the labour of daily feeding can be dispensed with by means of hopper-feeding. A large barrel or cask can also be utilized to hold a sufficient quantity of water to last for several days. A sprinkling of permanganate potash crystals now and again will keep the water in good condition.

Sunflowers or corn can be grown, and even potatoes or cabbages, on range at the same time as the chickens. Sunflowers or corn make splendid shade, and are a great protection against hawks, owls, blue-jays, etc. The constant cultivation needed by crops of this kind afford the chickens every facility to secure the abundance of

worms and insects turned up by the cultivator. An orchard is also an ideal location, especially if clover or alfalfa is available.

Where vermin abound it is advisable to shut chickens up at nights, and set traps to catch the marauders. For skunks, minks, and weasels, a portion of chicken carcass, sprinkled with strychnine crystals, is recommended. This should be placed near coop at night, and remains carefully removed before letting out the chicks. Dogs and cats should be kept shut up when this remedy is used.

For hawks, owls, and crows, an ordinary mink-trap, securely fastened to the top of a pole some 20 feet high, is recommended. The trap need not be baited. A rusty trap is more effective than a bright new one.

White strings festooned across the front of houses on sticks is successful in warding off hawks. It has been stated that the presence of guinea fowl will scare hawks from the poultry-yards. In the writer's experience this has proved a complete failure. Hawks were seen to repeatedly seize chicks within a few feet of a flock of guinea fowl.

Fireless brooders have not given universal satisfaction. One poultry-breeder in California used the fireless brooders with excellent success for two years, though the chicks were hatched later in the season than usual. It was tried again last year, early in the season, and was a total failure. The great difficulty is to keep the brooder perfectly dry. It is doubtful if the "fireless" system would prove satisfactory in this Province, with its moist climate; certainly not with the early hatches.

These chicks are all of one age, and affords an illustration of what sometimes happens when pullets' eggs are used for hatching; eggs from forced stock; inbred fowls; lice-infested chicks; improperly fed or improperly housed breeding stock.

Another system of brooding chicks involves the use of gasolene. The chief feature of this system is that the cost of brooding is materially lessened. Also there is less labour, since 150 or 200 chicks may be brooded together. The gasolene is placed in a tank considerably above the burner, and is connected with the burner by the use of ½-inch pipes. The burner is placed under the brooder-house, directly under the middle of the circular drum. The drum is fastened to the hover, which may be round or otherwise, and which is hinged to the side of the house. Gas which is generated from the gasolene is ignited at the burner, and this heats the drum,

a flue passing through the floor into the centre of the drum. An outlet at the back of the drum connects with a flue running up the back of the house which allows fumes to pass off. The temperature may be controlled by the use of thermostats. This system involves the same principles as in the round-hover brooding.

Instead of using gasolene with the galvanized-iron drum, the same kind of a brooder may be heated by means of hot-water pipes. One-inch pipes run lengthwise of the hover, being slightly lower at one end than the other. At the low end, heat is supplied either by kerosene or coal.

Many poultrymen of California have discarded this method, and have adopted the comparatively new method of "room" brooding. This brooder-house is generally 20 feet long by 12 wide, and is divided into two equal parts. In each room is a distillate burner, which heats the room for about 1,000 to 1,400 chickens. In the upper right-hand corner is placed a galvanized-iron tank. This is the supply-tank for the burner. Three grades of oil—engine, No. 28, and No. 34—may be used, but the engine-oil is more satisfactory than either of the other grades. All of these grades are extracts of the crude oil. From the supply-tank the oil passes through pipes under the floor to the burner. The burner is in the centre of the stove, and from the base of the stove a pipe reaches up to and through the ceiling. About 3 feet from the floor a large umbrella-shaped hover is attached to the pipe. When the burner has become sufficiently hot to convert the oil into gas, the burner-valve is turned on and the gas is ignited. The adoption of this method would only be justified on large poultry plants. There are quite a number of the room brooders in use in the Province at the present time. In some cases the owners have reverted back to the small individual hover, and in others the owners swear by the room-brooder method.

An expensive way of raising chicks. Chicks kept in such small quarters cost more to rear, inasmuch as everything they consume has to be provided for them, and in addition the ground becomes "chicken-tainted," causing disease and mortality. In such quarters chicks need to be supplied with green food. There is no comparison, as regards constitution, vigour, and size, between chicks reared in such quarters and those raised on free range, such as orchard, corn, or pasture land.

THE CONTINUOUS OR PIPE BROODER SYSTEM.

This system is quite often practised on extensive poultry-farms, while, on the other hand, the round hovers and other brooders originally adapted for the colony system are often installed in a continuous house. The larger the number of chicks that can be brooded together without doing any injury to one another, the less will be the cost. It is very doubtful if 1,000 to 1,500 chicks can be brooded together with entire satisfaction to the majority of breeders.

On large plants, where chicks are to be raised on a large scale, the brooder-house heated by hot-water pipes is one of the most economical. In this case, only one building is required, and all the work to be done in caring for the chicks can be done in the one place. There is only one fire to tend, and the work of feeding and watering the chicks can be done much easier than when the chicks are scattered about in individual brooders. However, there is no doubt but that the chicks have a little better chance in the colony brooders, for they are kept in small numbers, have less restricted range, and have a better chance to pick up more of their living. The furnace for heating purposes is usually situated in the basement, at one end of the brooder-house. The pipes run from the furnace to the other end of the house and return. The pipes may be of any size, the 1-inch and 2-inch sizes being most frequently used. These pipes, two "outflows" and two "inflows" or more, if necessary, run parallel to one another the length of the house, and are about 6 inches above the floor. In some brooder-houses the pipes are higher at the extreme end of the building than where they enter the furnace. This allows for graduted heat for chicks of different ages.

The runs attached to permanent brooder-houses should be of generous size. Many poultrymen in the past have not provided sufficient yard-room for brooder-chicks. Whatever size the yards may be, they should be frequently disinfected by air-slaked lime, dug up, and some quick-growing grain or vegetable planted, such as wheat, oats, rye, kale, millet, or rape. The latter is mostly used.

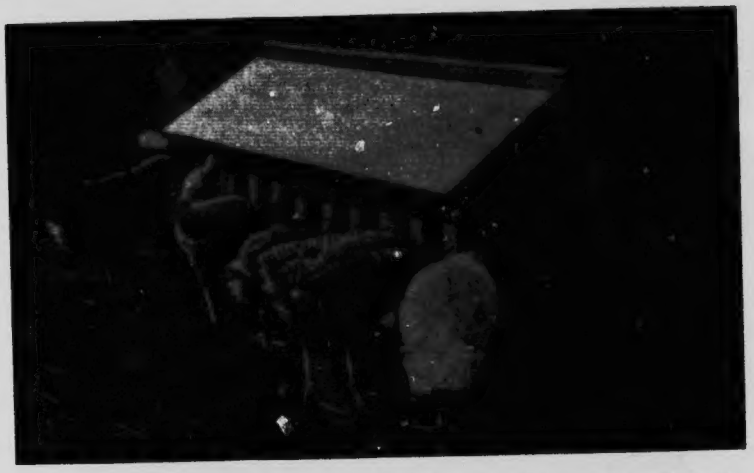


Fig. G.—A good serviceable grain-hopper. Can be made to any size, with partition running longitudinally down centre—one side being utilized for cracked or whole grain, the other for dry mash.

ADDITIONAL METHODS OF FEEDING.

No. 1. Whole-wheat bread is fed for the first day or two, and is gradually substituted by johnny-cake. After a few days, cracked corn and cracked wheat are fed. The johnny-cake is made of five parts cornmeal, one part wheat middlings, and one part beef-scrap, with a little soda mixed with sour milk and steamed until thoroughly cooked. Another johnny-cake is made of 2½ quarts of bran, 2½ quarts of cornmeal, 2 quarts of ground oats sifted, 1 quart of clover-meal. These are mixed with milk or water, with a pinch of soda added. Mix the whole thoroughly into a stiff dough and bake three to six hours in a slow oven.

No. 2. Feed cracker-crumbs or dried bread-crumbs, thoroughly mixed with finely chopped, hard-boiled eggs. There should be four or five times as much crumbs as there is egg. Pinhead oatmeal or rolled oats are also used. The chicks are fed this several times a day, and after a time cracked grains are fed.

No. 3. This method has been advocated by the Maine Experimental Station. Bread is made of a mixture of three parts cornmeal, one part wheat-bran, and one part wheat middlings or flour. This is mixed with milk or water and salt is added. It is well baked in a slow oven. The infertile eggs are boiled until hard, and are finely ground, shell and all. One part ground egg and four parts bread-crumbs are then mixed together, and run through a sausage-mill. The chicks are fed in the morning and at night on the bread-and-egg mixture. From after the morning feed until night they scratch in the litter for the dry cracked grain or chick-food which is provided for them. The egg mixture is used for about two weeks, after which time grains and mashes are used.

No. 4. From the first, the chicks are fed cracked wheat and finely cracked corn. This is scattered in the litter, and rolled oats are fed once or twice a day. In about two weeks a dry mash consisting of two parts cornmeal, three parts bran, two parts finely crushed oats, sifted, one part middlings, and one part beef-scraps is placed before the chicks.

No. 5. While the foregoing methods have commendable features, the following, though simple and involving less labour, gives good results and is much more satisfactory in feeding large flocks. During the first two or three days after feeding commences, the chicks are fed some good commercial "chick-feed" or a mixture of finely cracked corn and cracked wheat. In California they add to this cracked rice. The chicks are given this mixture several times a day. It is scattered in the litter and they scratch vigorously for it. After two or three days, they are given a dry mash. There is no one best mash, though some are superior to others. A very good mash is composed of two parts of bran, one part cornmeal, one part crushed oats, and one part beef-scraps. This mash should be fed in a hopper similar to that shown in Fig. G. When feeding this mash for the first time, it is best to give it immediately after they have had a good feed of their regular cracked-grain ration. This will tend to keep the chicks from overeating the dry mash and they will become accustomed to feeding from the hopper regularly. It is sometimes advisable to run the dry-mash mixture through a sieve for the first few feedings. The chicks thrive well on this combination ration. Some poultrymen in California and other places add rolled oats to the cracked-grain mixture. Rolled oats forms one of the best chick-feeds, and is comparatively inexpensive. Along with the cracked grains and dry mash, green food in the form of kale or lettuce should be given. Grit, fine particles of oyster-shell, and clean water should be kept before the chicks at all times.

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